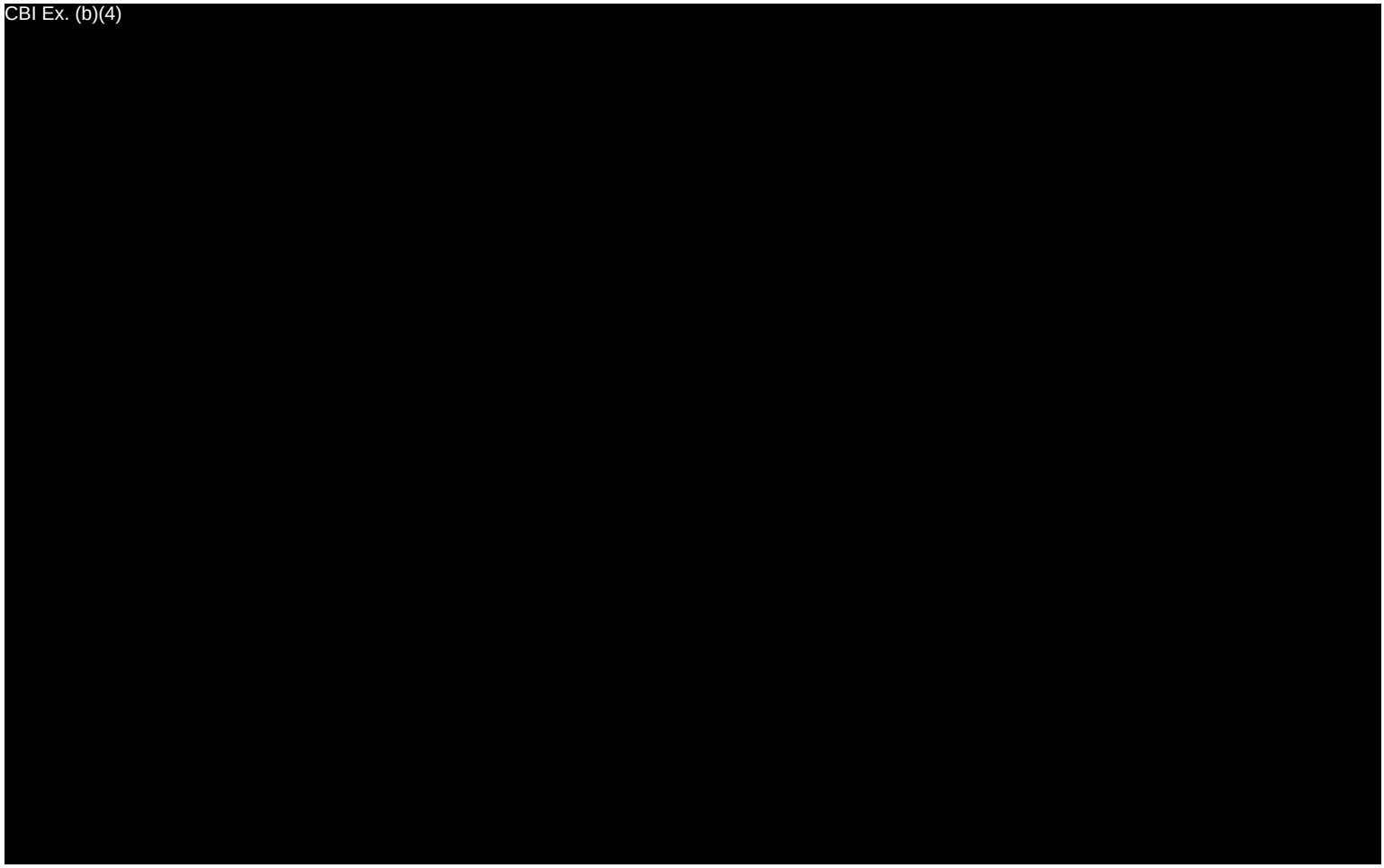
AMINE UNIT AND SRU PROCESS AUDIT FOR
THE LIMETREE BAY REFINING
ST. CROIX FACILITY

June 2021

Prepared for:
Limetree Bay Refining LLC
Christiansted, US Virgin Islands

CBI Ex. (b)(4)



CBI Ex. (b)(4)

[redacted]

3rd-party Process Audit of the Amine Regeneration Unit (ARU) and Sulphur Recovery Unit (SRU) following the US EPA Emergency Order dated 14 May 2021, pursuant to violations of the Clean Air Act for this facility. CBI Ex. (b)(4)

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[redacted]

3rd-party Process Audit of the Amine Units and Sulphur Recovery Units (SRUs) following the US EPA Emergency Order dated 14 May 2021, pursuant to violations of the Clean Air Act for this facility.

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CBI Ex. (b)(4) a Process Audit of the Amine Systems and SRU facilities at the Limetree Bay refinery in accordance with the EPA 05.14.2021 Clean Air Act Emergency Order (CAA-02-2021-1003) requiring outside auditing pursuant to flaring and emission exceedance events in April 2021. The refinery is located in St. Croix, in the US Virgin Islands.

With reference to "05.14.2021 Emergency Order" provided in Appendix A, the focus of the two Process Audit is on two events, one on April 23 and the second on April 25, 2021 as they relate to the operation failures of the Sulphur Recovery Unit (SRU). CBI Ex. (b)(4) The events relate to exceedance of the H_2S content in the header to Flare #8.

In the first event (item 52) Limetree Bay describe the H_2S exceedances as being due to No. 4 Sulphur Recovery Unit (4SRU) tripping because the flame scanners on the principal burner did not detect a flame (two out of two voting), which triggers an automatic shutdown of the unit. The "clean acid gas" (CAG) from the ARU's (also commonly referred to as amine acid gas), was forced into the Flare #8 header from a pressure relief valve in the upstream No. 5 Amine Regeneration Unit (5ARU).

In the second event (item 54) both 3SRU and 4SRU were contaminated by hydrocarbons in the clean acid gas that caused soot to form. This resulted in a plant back-pressure that exceeded the safety limit and the CAG feed to the SRUs was blocked in. Acid gas overloaded the 4ARU which adversely affected its ability to remove H_2S from the refinery fuel gas, putting it off-spec. The 5ARU was not available at that moment. Eventually, the load exceeded the capability of 4ARU and it relieved the acid gas to Flare #8.

In both instances the 162 ppmv H_2S limit (3-hour rolling average) in Flare #8 header was significantly exceeded. In the second incident the fuel gas H_2S content was also out of specification.

CBI Ex. (b)(4)

1.2 Scope of Work

With reference to the EPA 05.14.2021 Emergency Order Section 115, Part "j" Item 3 Audit Category B: Process Area Audit (page 38-39 of the Order, cited in Appendix A) , CBI Ex. (b)(4) CBI Ex. (b)(4) shall perform the following, quote:

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a. (Review) “Acid gas flaring events at Flare #8, particularly including hydrocarbon carryover from the amine units to the SRUs, what caused them, and physical changes and operational changes to prevent them from happening again in the future”.
b. “Review of procedures that can be implemented to avoid and minimize the impact of future acid gas flaring events, including:
    i. Operation of redundant amine treatment units and redundant SRU trains operated in standby; and
    ii. Sulfur shedding practices; and”
c. “An evaluation of staffing with regard to the operation and maintenance of the process unit, including staffing levels and whether operators have proper experience and training to operate the process unit (SRU) safely and withing required environmental limits”.
d. The content of the SRU Audit shall not be limited to the list of items in (a)-(c) if CBI Ex. (b)(4) CBI Ex. (b)(4) determined that additional evaluation should be conducted to prevent emissions or incidents that could endanger public health or welfare or the environment.

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The Limetree Bay Refinery has four separate Amine Regeneration Units (ARU's), designated as ARU's Nos. 4 through 7, or 4ARU, 5ARU, 6ARU, and 7ARU. The sour gas from these units act as feed for the two Sulphur Recovery Units (SRU's), designated as 3SRU and 4SRU.

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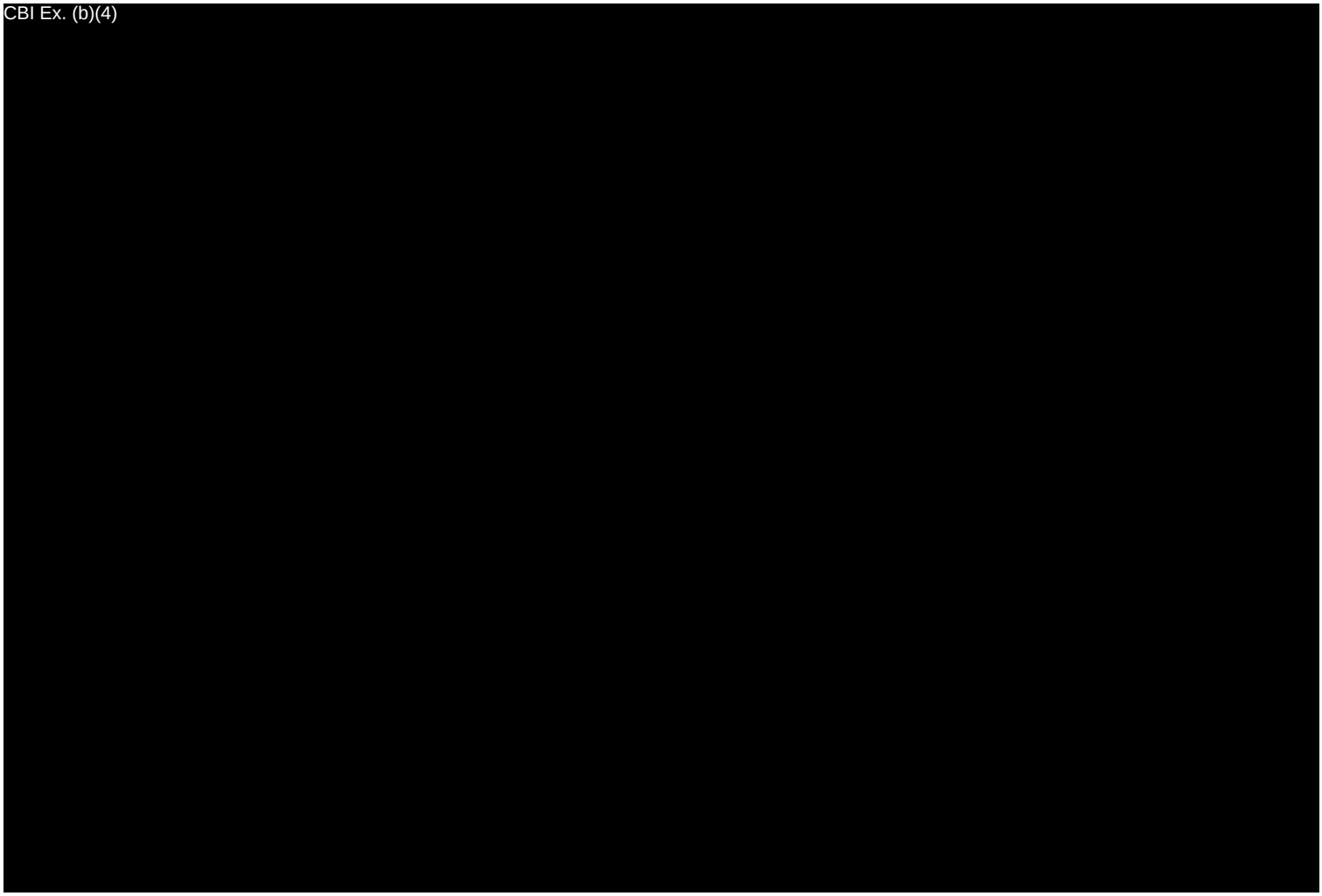

The Limetree Bay refinery amine units are identified as:

1. 4ARU
2. 5ARU
3. 6ARU (TGTU)
4. 7ARU (Coker)

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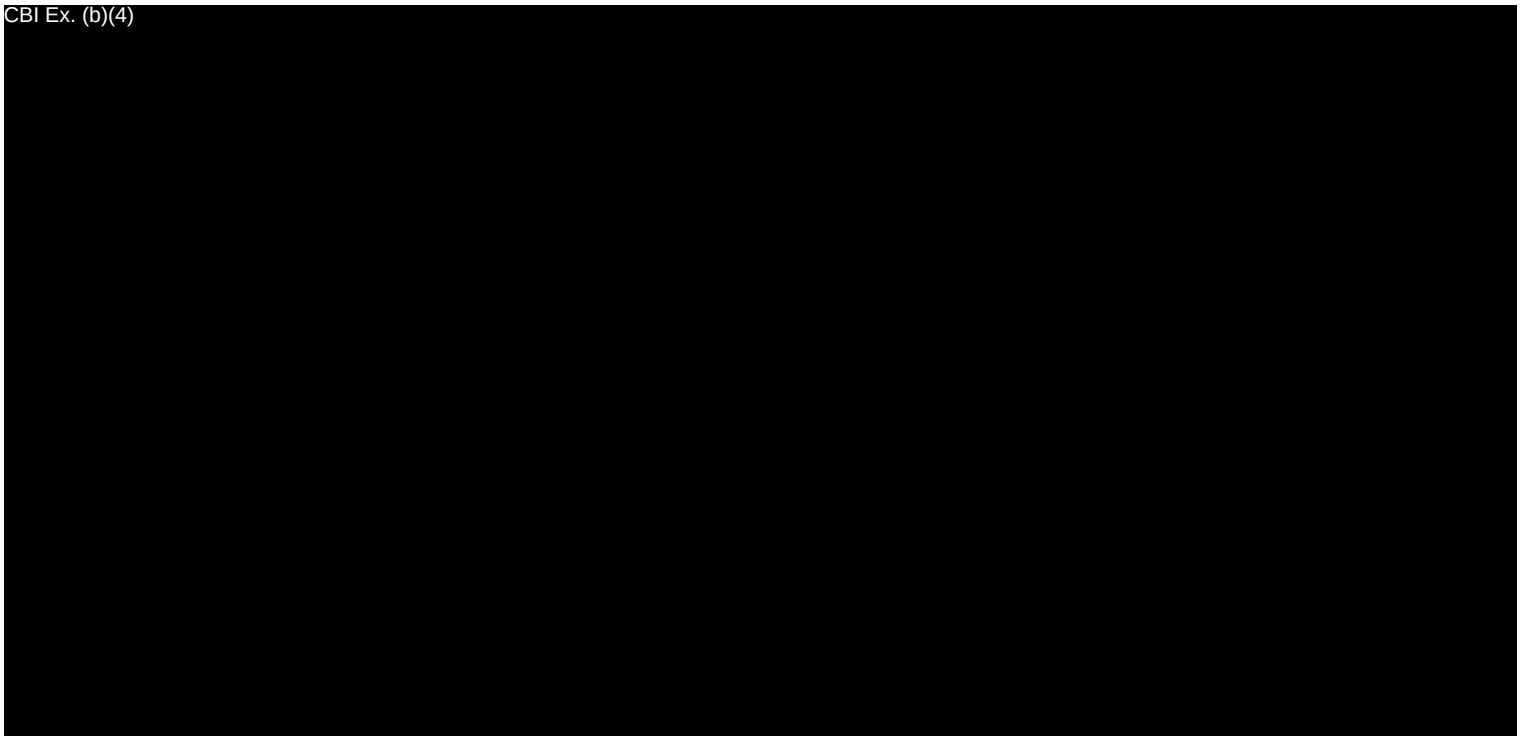

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Some of the upsets reported by Limetree Bay to the EPA that led to emissions exceedances were caused by hydrocarbon in the CAG entering the SRUs. CBI Ex. (b)(4)

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- CBI Ex. (b)(4) after a severe SO_2 breakthrough event in late April CBI Ex. (b)(4)

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CBI Ex. (b)(4) Some refineries have provisions in the environmental permit to allow temporary flaring during start-up and shutdown of the unit for a fixed period or mass release. However, in several locations in the USA there is a “zero flaring” policy, which automatically results in an environmental exceedance that requires reporting of the event in combination with the quantity of H_2S/SO_2 flared. The environmental regulatory requirements at Limetree Bay are a maximum of 162 ppmv (3-hour rolling average) for H_2S and 500 lb of SO_2 (in a 24 hour time period) in or from the LP flare system. The H_2S content in the gas header to the flare is continuously monitored by a CEMS. Typically only Flare #8 is in service for theses duties at Limetree Bay.

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